## CLAIMS

[1] An audio encoder comprising:

a downmix unit operable to downmix a multi-channel signal exceeding two channels to a two-channel stereo signal;

a first coding unit operable to generate a first coded signal by coding the downmixed stereo signal;

a second coding unit operable to generate a second coded signal by coding information for restoring the downmixed stereo signal to a multi-channel signal;

a code size calculating unit operable to calculate a code size of the second coded signal; and

a multiplexing unit operable to multiplex the first coded signal, the second coded signal and a signal representing the calculated code size.

[2] The audio encoder according to Claim 1,

wherein said multiplexing unit includes:

a first multiplexing unit operable to multiplex the code size calculated by said code size calculating unit and the second coded signal; and

a second multiplexing unit operable to multiplex the first coded signal with the second coded signal in which the code size is multiplexed.

[3] The audio encoder according to Claim 2,

wherein said first multiplexing unit is operable to multiplex the code size calculated by said code size calculating unit, placing the code size at the head of the second coded signal.

[4] The audio encoder according to Claim 2,

wherein said first multiplexing unit is operable to multiplex the code size calculated by said code size calculating unit, placing

the code size immediately after an indicator to identify the start of the second coded signal.

[5] The audio encoder according to Claim 2,

wherein said first multiplexing unit is operable to multiplex the code size in the second coded signal by describing the code size calculated by said code size calculating unit in variable length.

[6] The audio encoder according to Claim 1,

wherein said downmix unit is operable to perform an operation using a head-related transfer function, and to perform downmix processing on the multi-channel signal.

[7] The audio encoder according to Claim 6,

wherein said downmix unit is operable to perform the operation using the head-related transfer function on the multi-channel signal in a frequency domain.

[8] The audio encoder according to Claim 1,

wherein the second coded signal has invalid data, and

said code size calculating unit is operable to calculate a code size of the second coded signal having the invalid data.

[9] An audio decoder which decodes a coded signal, said decoder comprising:

an obtaining unit operable to obtain coded signals including a) a first coded signal obtained by coding a two-channel stereo signal downmixed from a multi-channel signal exceeding two channels, b) a second coded signal obtained by coding information for generating a multi-channel signal from the stereo signal, and c) a signal representing a code size of the second coded signal; and

a decoding unit operable to decode the obtained coded signals,

and to output a stereo signal.

[10] The audio decoder according to Claim 9,

wherein said decoding unit includes:

a first coded signal readout unit operable to read the first coded signal out of the obtained coded signals;

a code size readout unit operable to read a signal representing a code size of the second coded signal out of the coded signals; and

a first decoding unit operable to decode the first coded signal read out by said first coded signal readout unit, and to output the stereo signal, and

said first coded signal readout unit is operable to skip the second coded signal based on the code size read out by said code size readout unit.

[11] The audio decoder according to Claim 10,

wherein the first coded signal is coded from a stereo signal to which virtual surround-sound effect is applied beforehand by the operation using a head-related transfer function, and

said first decoding unit is operable to output the stereo signal to which virtual surround-sound effect is applied.

[12] The audio decoder according to Claim 9,

wherein the signal representing the code size of the second coded signal read out of the obtained coded signals is a signal representing the code size of the second coded signal having invalid data.

[13] The audio decoder according to Claim 9,

wherein said decoding unit further includes:

a first coded signal readout unit operable to read the first

coded signal out of the obtained coded signals;

a first decoding unit operable to decode the first coded signal read out by the first coded signal readout unit, and to output the stereo signal;

a second coded signal readout unit operable to read the second coded signal out of the coded signals;

a second decoding unit operable to decode a multi-channel signal based on the read-out first coded signal and the read-out second coded signal;

a filter unit operable to perform filter processing to the decoded multi-channel signal based on the head-related transfer function, and to output the stereo signal to which virtual surround-sound effect is applied; and

a selecting unit operable to select one of the stereo signal outputted out of the first decoding unit and the stereo signal to which virtual surround-sound effect is applied outputted out of said filter unit.

[14] The audio decoder according to Claim 13,

wherein said first decoding unit is operable to generate a frequency domain signal of the stereo signal, and

said filter unit is operable to perform filter processing based on the head-related transfer function to the frequency domain signal of the restored multi-channel signal from the frequency domain signal of the stereo signal, to generate a two-channel frequency domain signal, and subsequently to convert the frequency domain signal to a time domain signal.

[15] The audio decoder according to Claim 14, further comprising:

an electric power supplying unit operable to supply electric power in order to drive at least said second decoding unit; and

said selecting unit is operable to select the stereo signal from

said first decoding unit in a case where the electric supply from said electric supply unit falls to below a predetermined value.

[16] An audio coding method comprising:

downmixing a multi-channel signal exceeding two channels to a two-channel stereo signal;

generating a first coded signal by coding the downmixed stereo signal;

generating a second coded signal by coding information for restoring the downmixed stereo signal to a multi-channel signal;

calculating a code size of the second coded signal; and

multiplexing the first coded signal, the second coded signal and a signal representing the calculated code size.

[17] An audio decoding method for decoding a coded signal, said method comprising:

obtaining coded signals including a) a first coded signal obtained by coding a two-channel stereo signal downmixed from a multi-channel signal exceeding two channels, b) a second coded signal obtained by coding information for generating a multi-channel signal from the stereo signal and c) a signal representing a code size of the second coded signal; and

decoding the obtained coded signal and outputting a stereo signal.

[18] A program for running an audio encoder, said program causing a computer to function as the following respective units:

a downmix unit operable to downmix a multi-channel signal exceeding two channels to a two-channel stereo signal;

a first coding unit operable to generate a first coded signal by coding the downmixed stereo signal;

a second coding unit operable to generate a second coded

signal by coding information for restoring the downmixed stereo signal to a multi-channel signal;

a code size calculating unit operable to calculate the code size of the second coded signal; and

a multiplexing unit operable to multiplex the first coded signal, the second coded signal and a signal representing the calculated code size.

[19] A program for running an audio decoder which decodes a coded signal, said program causing a computer to function as the following respective units:

an obtaining unit operable to obtain coded signals including a) a first coded signal obtained by coding a two-channel stereo signal downmixed from a multi-channel signal exceeding two channels, b) a second coded signal obtained by coding information for generating a multi-channel signal from the stereo signal, and c) a signal representing a code size of the second coded signal; and

a decoding unit operable to decode the obtained coded signals, and outputs a stereo signal.